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AUTHOR Rowley, Thomas H.; Layne, B. H.
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ABSTRACT

Two experiments were conducted to evaluate the effectiveness of a computer-based instruction (CBI) tutorial in accounting education as compared to traditional classroom lectures. In the first experiment (involving over 200 students), two instructors taught one class section each using the lecture method and one class section each using the tutorial. Learning was measured in all four sections by the difference in posttest and pretest scores. In the second experiment, a large class of 100 students was divided randomly into 2 groups with one-half receiving the usual class lecture and the other half using the tutorial program via computer network. Results indicate that under-prepared students using the tutorial showed a greater increase in their amount of learning than those in the control group. However, students with average or above average entry level knowledge in the CAI tutorial group did not show statistically different results from students with average or above average entry level knowledge in the traditional groups. It is concluded that the challenges facing accounting education can be addressed effectively with microcomputer-based CBI applications. Data are presented in both narrative and tabular format. (11 references) (DB)

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EVALUATION OF CBI IN ACCOUNTING EDUCATION

Thomas H. Rowley
Assistant Professor
School of Accountancy
College of Business
Georgia State University

and

B.H. Layne
Professor
Education Foundations
College of Education
Georgia State University

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ABSTRACT

The theme of the 1990 ADCIS conference is appropriate to describe the challenge faced by accountants and accounting educators. The accounting profession has issued a challenge to the academic community to review the scope and content of accounting education. Committees of both the American Institute of CPAs (1989) and the American Accounting Association (1988) argue that more emphasis should be placed on higher order learning.

Meeting this challenge will require changes in the delivery methods. The increased use of effective, micro computer-based CBI tutorials in accounting education offers the opportunity to allocate class time to the development of higher order skills and provide students with an efficient means to develop the lower order skills.

This paper describes two experiments to evaluate the effectiveness of a CBI tutorial on the ability of students to prepare and explain a complex financial statement. Learning was measured by the difference in posttest and pretest scores. Thus, the statistical analyses compared only those students for whom there were both pre- and posttest scores.

For under-prepared students who used the tutorial the amount of learning increased slightly more than those in the control group. For students with average or above average entry-level knowledge, learning of those in the CBI and traditional groups was not statistically different.

The research implications are that innovative applications of micro computer-based CBI in accounting should be expanded. Educators proficient in CBI should seek opportunities to interact with their business school colleagues. The practical implications are that the challenges facing accounting education can be addressed effectively with CBI applications.

The accounting profession has issued a challenge to the academic community to seriously review the scope, content, and delivery of accounting education. Committees of the American Institute of CPAs (1989) and the American Accounting Association (1988) have published reports that are critical of the traditional methods of instruction. Accreditation boards are insisting on more use of computers in accounting education.

Economic analysis and financial reporting practices emphasize the ability to project an organization's future cash flows. Business students are introduced to the concepts of a complex financial statement, the Statement of Cash Flows (SCF), in their second accounting principles course. Students must remember and be able to apply many of the topics that were presented in the first accounting course. Those topics include the components of working capital and the implications of increases and decreases in the year-end balances of working capital accounts; the impact on net income of buying and selling long lived assets; and the difference between cash disbursements and expenses. Application of the material presented in the second course is also necessary to prepare the statement. That material describes the effect on net income of various financing alternatives. Students' ability to comprehend and utilize the SCF impacts their understanding of other economic and financial analyses they will encounter in later courses.

Student motivation and interest is often minimal since the accounting principles courses are required of all students regardless of intended business major. Abilities, knowledge, and skills vary across the student population in these classes. The principal difficulty in the second course is that students do not have a good grasp of the principles explained in the first course. They become frustrated by their inability to integrate and apply the previously studied information. They need this information to in order to complete the SCF analyses. Difficulties in teaching these students result from the combination of inadequate preparation and an unwillingness to ask questions that may expose their ignorance. These difficulties are widely recognized and are not unique to accounting. Successful completion of the course is important for the students because it must be passed in order to graduate from any business degree program.

This paper describes the results of an experiment using a micro computer-based accounting tutorial. The tutorial was developed and tested during two quarters using students enrolled in an accounting principles course. This controlled experiment evaluated the effectiveness of CBI in facilitating students' learning of the preparation of the Statement.

Computer based training in introductory accounting has been researched by McKeown (1976) and Groomer (1981) and shown to be efficient. But those earlier efforts involved expensive hardware

configurations using Plato IV. Other efforts cited by Lewis, et al. (1985) and Williams, et al. (1987) support the conclusions that CBI's strength is its cost effectiveness when compared with traditional teaching methods. Helmi (1986) suggests that micro computer based instruction is an appropriate arena for accounting research in the '90s.

METHOD

Computer tutorials are generally recognized as effective when they are:

> aimed at specific groups of students; integrated with classroom instruction; used for specific subject matter, and proper setting and scheduling are established (Zemke, 1984, p 41).

They are useful for achieving level 1 through 3 of Bloom's (1956) taxonomy. The tutorial used in this study applies to the cognitive domains of knowledge, comprehension, and application and is designed to serve as a supplemental teaching tool. The tutorial reinforces textbook information and provides an alternative to lengthy class sessions spent going over repetitive problem solution demonstrations.

The SCF tutorial provides a focused application of the concepts of working capital, investing, and financing activities as they relate to the cash flow of an organization. Since this focus is provided in a flexible and easily accessible context, it is expected the amount of learning to increase. Such improvement would result from the fact that the student has been

concentrating on the activity in a one-to-one situation, and can rework any module until he or she satisified. Thus, the threat of negative peer pressure would be reduced along with the risk of exposing any lack of preparation.

Specifically, the four interactive modules in the SCF tutorial focus on Bloom's domains of terminology; conventions; classifications and categories; and methodology. One module includes an interactive electronic spreadsheet problem that provides practice in preparing the SCF. This module also helps to avoid excessive frustration resulting from a student's poor math skills, since the student does not have to do the computations. The student only fills in the correct data items for the appropriate beginning and ending account balances. The spreadsheet performs the calculations and shows how the changes in year-end balances are used to develop the three sub-sections of the SCF. Those sub-sections of the Statement present the impact of the organizations operating activities on working capital, and shows sources and uses of cash derived from both investing and financing activities. The other three tutorial modules describe those three sections of the Statement.

The tutorial is designed so that adult learners better understand the objectives of the learning experience and its relationship to their success in completing the course material (Long, 1983; Mager, 1984). The introductory module states not only its objectives but also those of the other three interactive

modules. Each module's introductory screen describes the context and impact of that particular portion of the tutorial on the preparation of the SCF. Descriptions include answers to "why" as well as to "how." Feedback is different for each of the various responses to imbedded questions. Correct answers are positively reinforced while feedback is also provided as to why any incorrect answers may have been selected. Transparent administrative modules track each user's interaction. The final screen shows the user how many modules were used, how many questions were attempted, how many questions were correctly answered, and the date and elapsed time of use. This information, along with the user's name and social security number, is also transferred to an administrative file which can be printed out for the instructor.

The tutorial was developed in order to test the hypothesis that micro computer-based tutorials are as effective as the traditional stand-up lecture with respect to student learning of the Statement of Cash Flows. Learning was measured using scores from pretests and posttests. Retention was also assessed using scores on a departmental exam covering the related material. Psychological type was measured using a self-scored version of the Meyers Briggs Type Indicator.

The pretest and posttest instruments were developed from a standardized test bank that accompanies the principal text for the course. The instruments were tested using nearly 500

accounting principles students. The content of the pre- and posttest were identical except that an "I don't know" option available on the pretest was not available on the posttest. The "I don't know" response, which was treated as a wrong answer in scoring the pretest, was included so that students wouldn't feel pressure to guess on items that related to material not yet covered in the class. Forty percent of the test dealt with material covered in the previous course, the remainder with the SCF elements and procedures covered in the class in which the studetns were enrolled at the time of the study.

Tutorial module contents were developed by the author. The early development of the screens was discussed with university and professional colleagues familiar with the development of CBI. Pacing, color combinations, and window formats were selected and designed to provide an interesting environment without distracting from the content.

Two controlled experiments were conducted during two quarters using. The combined enrollment in the classes exceeded 200 accounting principles students. Pretest and demographic data were collected at the beginning of each quarter. Posttest data were collected about four weeks later, following the coverage of the SCF content. A departmental exam was administered two weeks after the material was covered. Scores were compared across groups to determine whether there were differences in learning and retention. The two experiments are briefly summarized below.

Statistical tests were performed in order to compare mean scores on the pre- and posttests for those students who took both of the tests (refer to Tables 1 and 2).

Experiment 1 Four class sections participated, with about 40 students each. The sections were taught by two graduate student instructors. One class of each instructor served as a control, and was given the traditional lecture and problem solving approach. For each instructor, the other class used the tutorial. Retention scores of the groups were tracked by SSN and compared statistically. Retention was measured by scoring the subset of the departmental midterm examination items that covered the SCF material.

Experiment 2 One of the authors taught a large section of accounting principles class in which over 100 students were enrolled. Over half of the students were randomly selected on the basis of their social security numbers (SSN) and were invited to use the tutorial in lieu of the usual class coverage. The computer network was available in the room adjacent to the lecture hall, and students were scheduled for the tutorial at the same time as the regular class.

RESULTS

Results of the two experiments indicate that this tutorial is approximately twice as efficient and just as effective as the traditional, stand-up lecture. The typical tutorial user spends

about 40 minutes working through the entire set of modules, including the practice problem. The traditional lecture and problem demonstration lasts between 90 and 120 minutes. This confirms the general cost-effectiveness of CBI shown in earlier studies described by Williams, et al.(1987).

Neither the pretest nor posttest scores were statistically different in either experiment. The posttest scores of the tutorial group were slightly lower than the traditional instruction group, but the tutorial groups retention scores were higher. The pretest and posttest averages of the tutorial user group in the second experiment are both lower than the respective averages of those who did not use the tutorial. The increases in posttest scores and retention scores were nearly identical for both groups in the second experiment. Tables 1 and 2 present the details of the demographic data as well as the test scores for both experiments.

FUTURE RESEARCH OPPORTUNITIES

The evolution of the tutorial toward becoming an "intelligent" tutor is currently under development. Pretest and posttest modules are now being incorporated in order to replace pencil and paper procedures. Based on the results of this new pretest, directions will be presented to the user about which modules will be most beneficial. A module to assess each user's learning style is now being contemplated as well. Feedback will

be modified on the basis of the user's preferred style.

ADCIS members are faced with a rich opportunity for interaction -- cross pollination if you will. Few accounting academics have credentials in instructional design or formal education in developing training materials. There are some who have an interest in and enthusiasm for the rich potential of CBI to permit educators to focus their efforts on Bloom's higher levels of learning. We encourage ADCIS members who are interested in finding outlets for practical applications of their skills to seek out their colleagues in the business schools. Engage in resource sharing and enjoy the personal satisfaction of professional growth that can result from such a collaboration.

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TABLE 1
TEST SCORES AND DEMOGRAPHICS
EXPERIMENT 1

	Used Tutorial	Did Not Use Tutorial	
	N=39	N=33	
	%	%	
Gender Males	43.6	39.4	
Females	56.2	60.6	
Prior course grade			
A	25.6	27.3	
B	35.9	27.3	
C	38.5	42.4	
D	--	--	
Missing	--	3.0	
Overall GPA			
under 2.0	7.7	12.1	
2.1 - 2.5	25.6	24.2	
2.6 - 2.9	25.6	14.2	
3.0 - 3.5	23.1	21.2	
3.6 - 4.0	15.4	18.2	
Missing	2.6	--	
			t-test
Pretest			
Mean	36.4%	35.2%	t=.335 (p=0.72)
S.D.	14.41	15.43	
Posttest			
Mean	64.8%	68.5%	t=.902 (p=0.37)
S.D.	17.75	16.22	
Subset of Midterm	**(N=38*)**	**(N=31*)**	
Mean	71.1%	69.6%	t=.343 (p=0.40)
S.D.	18.63	16.79	

* Smaller size due to missing data.

TABLE 2
TEST DATA AND DEMOGRAPHICS
EXPERIMENT 2

		Used Tutorial	Did Not Use Tutorial	
		N=19	**N=24**	
Gender	Males	47.4%	62.5%	
	Females	52.6%	37.5%	
Preceeding course grade				
	A	5.3	16.7	
	B	31.6	25.0	
	C	63.2	58.3	
	D	--	--	
Overall GPA				
	under 2.0	10.5	4.2	
	2.1 - 2.5	42.1	29.2	
	2.6 - 2.9	31.6	33.3	
	3.0 - 3.5	15.8	20.8	
	3.6 - 4.0	--	8.3	
	Missing	--	4.2	
				t test
Pretest				
	Mean	43.2%	47.5%	t=.856 (p=0.40)
	S.D.	16.34	16.75	
Posttest				
	Mean	63.7%	66.3%	t=.619 (p=0.54)
	S.D.	13.00	14.08	